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COST AND PERFORMANCE
OF FULL-TELESCOPE CORRUGATED BOXES
FOR SHIPPING COLORADO-GROWN CARNATIONS

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CONTENTS

	<i>Page</i>
Summary	1
Introduction	1
Description of shipping containers	2
Procedure	3
Performance of containers	3
Time and temperatures in transit	3
Flower damage	3
Container damage	3
Handling and trade acceptance	4
Costs of packaging and transport	4
Packaging material and direct labor costs	4
Transport charges	4
Total costs and charges	5
Discussion	5

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**COST AND PERFORMANCE
OF FULL-TELESCOPE CORRUGATED BOXES
FOR SHIPPING COLORADO-GROWN CARNATIONS¹**

By Robert Tom *Hinsch*, *agricultural economist*, and Roger E. Rij,
agricultural marketing specialist, Transportation and Facilities
Research Division, Agricultural Research Service

SUMMARY

Colorado carnation growers ship their flowers to market in four sizes of full-telescope corrugated design-style boxes. Although costly, these containers are sturdy and provide good protection to the carnations. Examination of 11,925 carnations in 12 air-freight commercial shipments to "off-line" markets showed that only 2.5 percent of the flowers were damaged. Only one of the 21 containers observed was seriously damaged and that damage was caused by rough handling.

An average of more than 22 hours elapsed from the time that the carnations were packed in Denver, Colo.,

until they reached the retailers in eastern cities. More than half of this time was spent at the transfer airports.

The cost of packaging materials, direct-packing labor, and average transport charges from Denver, Colo., packinghouses to seven major U.S. markets, per flower, was 2.2 cents for 190 carnations packed in the smallest box used by the Colorado carnation industry; 1.6 cents for 375 carnations packed in a small, medium size box; 1.5 cents for 500 carnations packed in a large, medium size box; and 1.3 cents for 825 carnations packed in the largest box used by the industry.

INTRODUCTION

Colorado carnation producers sold an estimated 145 million cut carnations, representing a wholesale value of \$12.5 million, in 1969.¹ About two-thirds of these carnations were airfreighted to their market destinations. However, direct-through air service is unavailable to many of the markets served by Colorado carnation producers. Flower shipments to these "off-line" markets must be either transferred between two or more flights or shipped by truck or bus from the airport to another city. These shipments often encounter delays, rough handling, and wide variations in temperature at the transfer points that sometimes result in physically damaged or poor-quality flowers.

Some Colorado carnation shippers thought that their shipping containers might not be performing

satisfactorily in protecting the flowers for shipments to "off-line" markets. Therefore, at the request of the Colorado carnation industry, observations were made on several commercial "off-line" market shipments to evaluate the performance of the shipping containers.

Four different size boxes are used for shipping an average of 190, 375, 500, and 825 flowers in the open-flower stage. Marketing costs can be reduced by packing and shipping more cut carnations per box in the bud stage than in the open-flower stage, but most of the Colorado carnations are shipped while open.²

The purpose of this study was to find out (1) the amount of container and flower damage that occurs in shipments to "off-line" markets, and (2) the cost of packaging and transport of Colorado-grown carnations.

¹ U.S. Dept. Agr., Flowers and Foliage Plants—Production and Sales 1968 and 1969—Intentions for 1970 in Selected States, Crop Rpt. Board, SP CR 6-1 (70) April 1970.

² Guilfoy Jr., R. F., and Lundquist, A. L., Transport and Handling of Carnations Cut in the Bud Stage—Potential Advantages, U.S. Dept. Agr. Market. Res. Rpt. No. 889, 13 pp. 1970.

DESCRIPTION OF SHIPPING CONTAINERS

Three of the four sizes of full-telescope corrugated design style boxes³ used for shipping carnations from Colorado were evaluated in the 12 commercial "off-line" market shipments (table 1). The outside dimensions of the boxes evaluated varied in size from 36 by 16 by 10 inches to 46 by 19 by 12 inches. For identification purposes, the Colorado carnation industry designates these three containers as 6C, BAC, and 10C boxes. A smaller, full-telescope corrugated box (4C) with outside dimensions of 36 by 12 by 9 inches is used also. The cost of the box was evaluated, but no shipments were made.

An inverted fiberboard "V" insert was placed in the bottom of the box to help support the stems and to bind the flowers in place (figure 1). The box was then lined with a sheet of 1½ mil, polyethylene film. The flowers were bunched—25 stems were held together with a rubber band—and placed horizontally in the container with the stems lying across the "V" board and with some of the heads at each end of the container. A 9- by 12-inch sheet of waxed paper was placed between the heads of each flower bunch. Eight sheets of newsprint were placed on top of the packed flowers, and a wood cleat was stapled into the container walls across the middle of the box to hold the flowers in place.



Figure 1.—Full-telescope corrugated box used for shipping carnations from Colorado.

Table 1.—Outside dimensions, cubic displacement, tare weight, and number of cut flowers for Colorado carnation shipping containers, 1970

Item	Unit	Container identification ¹			
		4C ²	6C	BAC	10C
Outside dimensions	Inches	36x12x9	36x16x10	36x20x11	46x19x12
Outside cubic displacement	cubic inches	3,888	5,760	7,920	10,488
Tare weight	pounds	7.50	9.00	11.00	13.75
Maximum number of flowers ³	Number	200	400	750	1,000
Average number of flowers ⁴	Number	190	375	500	825

¹ These container identifications have been adopted by the Colorado carnation industry. ² Container 4C was evaluated for cost only. It was not test shipped, because representatives of the Colorado carnation industry advised that they had no major problems with the handling and shipping of this size

box. ³ Maximum number of carnations packed in each box.

⁴ Average number of carnations packed in each box according to the Colorado carnation industry. The number actually packed varies considerably in accordance with each customer's order.

³ Hereafter, the full-telescope corrugated design-style boxes will be referred to as full-telescope corrugated boxes.

PROCEDURE

Twelve commercial airfreight test shipments of carnations were made from Denver, Colo., to several eastern markets not served by direct airline flights. A recording thermometer was attached to the outside of the container to measure air temperature during transit.

Container damage, bloom bruising, and stem breakage were determined by visual inspection on arrival in the receiver's warehouse in the "off-line" market.

Packaging material costs were obtained from container manufacturers and suppliers and carnation

growers. All packaging material costs are based on price per thousand units for car lot orders. Direct labor costs for packing the containers were obtained by making time studies in two carnation packinghouses. A \$2-per-hour wage rate was used to calculate packing-labor costs.

Transport charges were determined from receiver records, local delivery firms, and published airfreight tariffs. Costs of equipment, receiving, storage, supervision, sales, and overhead were not included in this study.

PERFORMANCE OF CONTAINERS

Time and Temperatures in Transit

An average of 22.3 hours elapsed from the time that the 12 "off-line" market shipments left the packinghouse in Denver, Colo., until they were received by the wholesaler or retailer (table 2). Holding the shipments at the "transfer point" accounted for an average of over one-half the time spent in transit.

The average air temperature around the flower boxes ranged from 60.8° F. while being held at the

transfer point to 68.0° F. while enroute from the packinghouse to the Denver airport (table 2).

Flower Damage

Four percent of the carnations in the 6C box arrived with flower damage, whereas 3.1 percent in the BAC box and 0.8 percent in the 10C box arrived with flower damage (table 3). Of the 11,925 carnations—1,925 in six 6C boxes, 6,050 in nine BAC boxes, and 3,950 in six 10C boxes—shipped in the 12 "off-line" market test shipments, an average of 2.5 percent arrived with bloom damage or stem breakage.

Table 2.—Average length of time in transit and average air temperatures of carnations in 12 "off-line" market shipments, by phase of transit, Denver, Colo., to eastern United States markets, 1967

Phase of transit	Transit time		Air temperature
	Average per shipment	Percentage of total transit time	
	Hours	Percent	Degrees F.
Packinghouse to airport	0.5	2.2	68.0
Held at Denver airport	1.9	8.5	64.8
Flight time	4.2	18.7	61.8
Held at transfer airport	11.6	52.0	60.8
"Off-line" transit time	1.7	7.8	61.2
Held at receiving airport	1.7	7.8	62.7
Delivery to receiver .....	.7	3.0	67.4
Total or average	22.3	100.0	63.8

Table 3.—Percentage of carnations damaged, by size of box, in 12 "off-line" air shipments, Denver, Colo., to eastern markets, 1967

Item	Container identification			Average, all shipments
	6C	BAC	10C	
Bloom bruising . . .	0.0	2.5	0.6	1.5
Stem breakage . . .	4.0	.6	.2	1.0
Total	4.0	3.1	.8	2.5

Container Damage

In the 12 shipments made to "off-line" markets, none of the 6C boxes were damaged (table 4). Two BAC boxes were slightly damaged, and one of the 10C boxes was seriously damaged on arrival at "off-line" markets. The slightly damaged boxes were reusable, but had small puncture holes or tears in the fiberboard caused by contact with other freight during transport or ground handling. The seriously damaged box was crushed as a result of mishandling and was not reusable.

Table 4.—Number of carnation containers damaged, by size of box, in 12 "off-line" air shipments, Denver, Colo., to eastern markets, 1967

Item	Container identification			All shipments
	6C	BAC	10C	
	Number	Number	Number	Number
Number of boxes shipped	6	9	6	21
Slightly damaged ¹	0	2	0	2
Seriously damaged ²	0	0	1	1

¹ Slightly damaged—small puncture holes or tears, but reusable. ² Seriously damaged—crushed and not reusable.

Handling and Trade Acceptance

The suitability of full-telescope corrugated boxes for packing, handling, and receiving carnations is generally adequate. Floral wholesalers like the boxes because they are suitable for repacking and shipping flowers to the retail florists. However, the large 10C box and medium-large, BAC box are clumsy and difficult to handle. The handling difficulty may be the cause of these larger boxes being more easily damaged. The largest of these boxes, completely filled, may weigh as much as 70 pounds. Some retail florist employees may find it difficult to handle them.

COSTS OF PACKAGING AND TRANSPORT

Packaging Material and Direct Labor Costs

The costs of packaging materials and direct packing labor for an average of 190 carnations in a 4C box were \$1.14 (table 5). These costs were \$1.35 for 375 carnations in a 6C box, \$1.54 for 500 carnations in a BAC box, and \$1.91 for 825 carnations in a 10C box. The cost per flower packed in a 4C box was almost three times as much as the cost per flower packed in a 10C box.

Table 5.—Costs of packaging materials and direct labor to pack carnations in four full-telescope corrugated boxes, Denver, Colo., 1970

Item	Container identification			
	4C	6C	BAC	10C
	Dollars	Dollars	Dollars	Dollars
Packaging materials ¹	1.01	1.21	1.40	1.77
Direct packing labor ² ..	.13	.14	.14	.14
Total	1.14	1.35	1.54	1.91
	Cents	Cents	Cents	Cents
Cost per flower .....	.60	.36	.31	.23

¹ Includes boxes, a 1½-mil, polyethylene sheet, cleats, newsprint, insulation material, and closure materials. ² These are direct labor costs of making, packing, and closing the box. Does not include costs such as supervision, overhead, fieldmen, insurance, sales, or office workers.

Transport Charges

Trucking and air transport charges, based on an average freight rate to seven United States markets, were 1.60 cents per carnation packed in the 4C box;

1.27 cents in the 6C box; 1.20 cents in the BAC box; and 1.07 cents in the 10C box (table 6). Less tare weight per flower and a smaller outside cubic displacement per flower for the larger boxes were the principal factors accounting for the difference.

Table 6.—Average transport charges for carnations shipped from Denver, Colo., to seven major U.S. markets, by size of shipping container, 1970-71

Item	Container identification ¹			
	4C	6C	BAC	10C
	Dollars	Dollars	Dollars	Dollars
Wholesale house to airport ²	0.50	0.50	0.50	0.50
Airport to airport ³	2.22	3.70	4.81	7.28
Airport to receiver ⁴ .....	.33	.55	.71	1.07
Total transport cost per box .	3.05	4.75	6.02	8.85
	Cents	Cents	Cents	Cents
Cost per flower	1.60	1.27	1.20	1.07

¹ Based on an average gross weight of 18 pounds for 190 carnations packed in the 4C box; 30 pounds for 375 carnations in the 6C box; 39 pounds for 500 carnations in the BAC box; and 59 pounds for 825 carnations in the 10C box. ² Cost based on average trucking charge of \$.50 per box in Denver, Colo.

³ Air transport charges based on an average freight rate of \$12.34 per 100 pounds (from Denver, Colo., to: Atlanta, Ga., \$12.85; Chicago, Ill., \$8.36; Dallas, Tex., \$11.05; Minneapolis, Minn., \$10.40; New York, N.Y., \$15.70; Pittsburgh, Pa., \$13.85; and Washington, D.C., \$14.20). ⁴ Airport to receiver charges based on an average trucking rate of \$1.82 per 100 pounds (in Atlanta, Ga., \$1.00; Chicago, Ill., \$1.60; Dallas, Tex., \$1.00; Minneapolis, Minn., \$1.20; New York, N.Y., \$2.55; Pittsburgh, Pa., \$1.55; and Washington, D.C., \$3.87).

Total Costs and Charges

The cost of packaging materials, direct-packing labor, and average transport charges from Denver, Colo., packinghouses to seven major U.S. markets for 190 carnations packed in the 4C box was \$4.19 (table 7). These costs and charges were \$6.10 for 375 carnations packed in a 6C box, \$7.56 for 500 carnations packed in a BAC box, and \$10.76 for 825 carnations packed in a 10C box.

Lower packaging material cost and lower packaging material weight per flower, which resulted in lower transport cost per flower, were the principal factors accounting for the lower costs of marketing the carnations in the larger boxes.

Table 7.—Costs of packaging materials, packing labor, and transport for Colorado carnations shipped from Denver, Colo., to seven major U.S. markets, by size of shipping container, 1970-71

Item	Container identification			
	4C Dollars	6C Dollars	BAC Dollars	10C Dollars
Packaging materials	1.01	1.21	1.40	1.77
Direct packing labor .....	.13	.14	.14	.14
Transport	3.05	4.75	6.02	8.85
Total	4.19	6.10	7.56	10.76
	Cents	Cents	Cents	Cents
Cost per flower ...	2.2	1.6	1.5	1.3

DISCUSSION

The containers that are presently being used by the Colorado carnation industry performed adequately, based on a limited number of observations. If a greater number of commercial shipments had been observed, more container and flower damage might have been found. Although flower and container damage in this study was not severe, long layovers and additional handlings at transfer points provide the opportunity for flower and container damage. Over one-half of the transit time was spent at the transfer point.

The high cost of air freight, the need for standardizing dimensions of shipping containers to fit efficiently

into air cargo containers, and the lack of damage to carnations shipped in the containers being used by the industry indicate that the cost of packaging and transport of carnations might be reduced by further research to develop new sizes of shipping containers. Packaging and transport costs also could be reduced if retail florists would order enough carnations to completely fill the containers instead of receiving only partly filled containers. Receivers also might reappraise their purchasing habits and have less frequent shipments with more flowers per shipment to take advantage of the savings made possible by using the large shipping containers.

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